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A NEW GENUS OF PRIMITIVE CRANE FLIES (DIPTERA: TANYDERIDAE) IN CRETACEOUS BURMESE AMBER, WITH A SUMMARY OF FOSSIL TANYDERIDS

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Abstract.—A **new genus and species** of primitive crane flies, ***Dacochile microsoma*** **Poinar and Brown** (Tanyderidae) is described from Cretaceous Burmese amber. It differs from extant and extinct members of the family by the following combination of characters: small size (wing length, 2.8 mm), reduced anal lobe, hyaline wing membrane, crossvein cua-a_1 forming cell cua, very short vein R_{2+3}, very long terminal maxillary palps, and mandibles. The well-developed mandibles indicate that the species obtained food by piercing and sucking. A list of fossil tanyderids is presented.

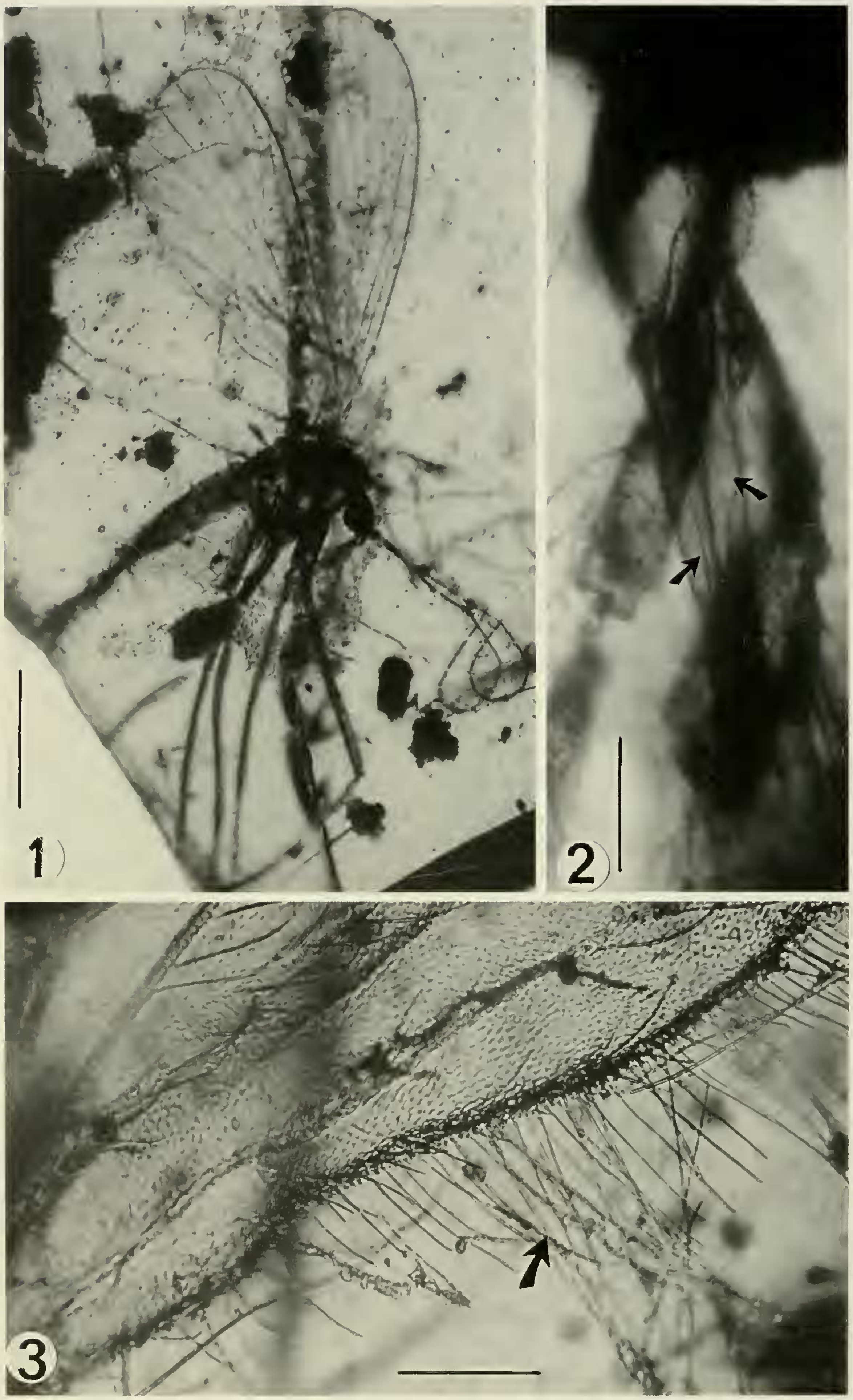
Key Words: *Dacochile* n. gen., *Dacochile microsoma* n. sp., Tanyderidae, Burmese amber, Cretaceous

The Tanyderidae, or primitive crane flies, possess many plesiomorphic characters, especially regarding the wing venation. The family consists of 12 extant genera, most in the Southern Hemisphere. The adults occur in moist terrestrial habitats while the larvae are found in shallow water or along the margins of lakes, rivers and streams, usually in sediment or rotting vegetation (Alexander 1981). Origin of the family and its relationship with other Nematocera has been of interest, and fossils from the Eocene and Jurassic have been reported (Table 1).

A female tanyderid discovered in Cretaceous Burmese amber, described below in a new genus, provides insight into the morphology of early members of this interesting group. Amber from Burma occurs in lignitic seams in sandstone-limestone deposits in the Hukawng Valley (Poinar 1992, Zherikhin and Ross 2000). Nuclear magnetic resonance (NMR) spectra of amber samples taken from the same locality as the fossil indicated an araucarian (possibly *Agathis*) source of the amber (Lambert and Wu, unpublished research 2002). Palynomorphs obtained from the amber beds where the fossil originated have been assigned to the Upper Albian (~100–110 mya) of the Lower Cretaceous (Cruickshank and Ko 2002).

MATERIALS AND METHODS

The amber was recut and polished in order to view the specimen better. The amber piece containing the fossil is rectangular in outline, measuring 7 mm in greatest length, 5 mm in greatest width and 1 mm in greatest depth. The specimen is well preserved and nearly complete, with only the tips of the tibiae and ovipositor missing. Observations, drawings and photographs were made with a Nikon SMZ-10 stereoscopic microscope and Nikon Optiphot optical microscope (with magnifications up to 650×). In the following description, terminology is



Figs. 1–3. *Dacochile microsoma.* 1, Holotype in Burmese amber. Bar = 836 μm. 2, Proboscis with well-developed mandibles (arrows). Bar = 95 μm. 3, Anal region of wing showing long setae emerging from costal vein (arrow). Note microtrichia on wing membrane. Bar = 103 μm.

that presented in the "Manual of Nearctic Diptera" (McAlpine 1981).

The presence of a radius with 5 branches all ending at the wing margin, the subcosta bifurcate at its extremity, with the basal branch appearing as a crossvein ending in R_1, a single anal vein reaching the margin, the costa continuing around the wing margin, setae between the ommatidia and cell br (first basal cell) longer than cell bm (second basal cell) place the fossil in the family Tanyderidae Osten-Sacken 1879.

Dacochile Poinar and Brown, new genus

Type species: Dacochile microsoma Poinar and Brown.

Description.—Body (length, 2.6 mm) and wing (length, 2.8 mm) small, anal lobe greatly reduced, anal margin slightly concave; wing membrane hyaline, crossvein cu a-a_1 forming cell cu a, vein R_{2+3} short, mandibles well developed.

Etymology.—Daco is from the Greek "dakno" for bite; chile is from the Greek "chilo" for lip; the gender is neuter.

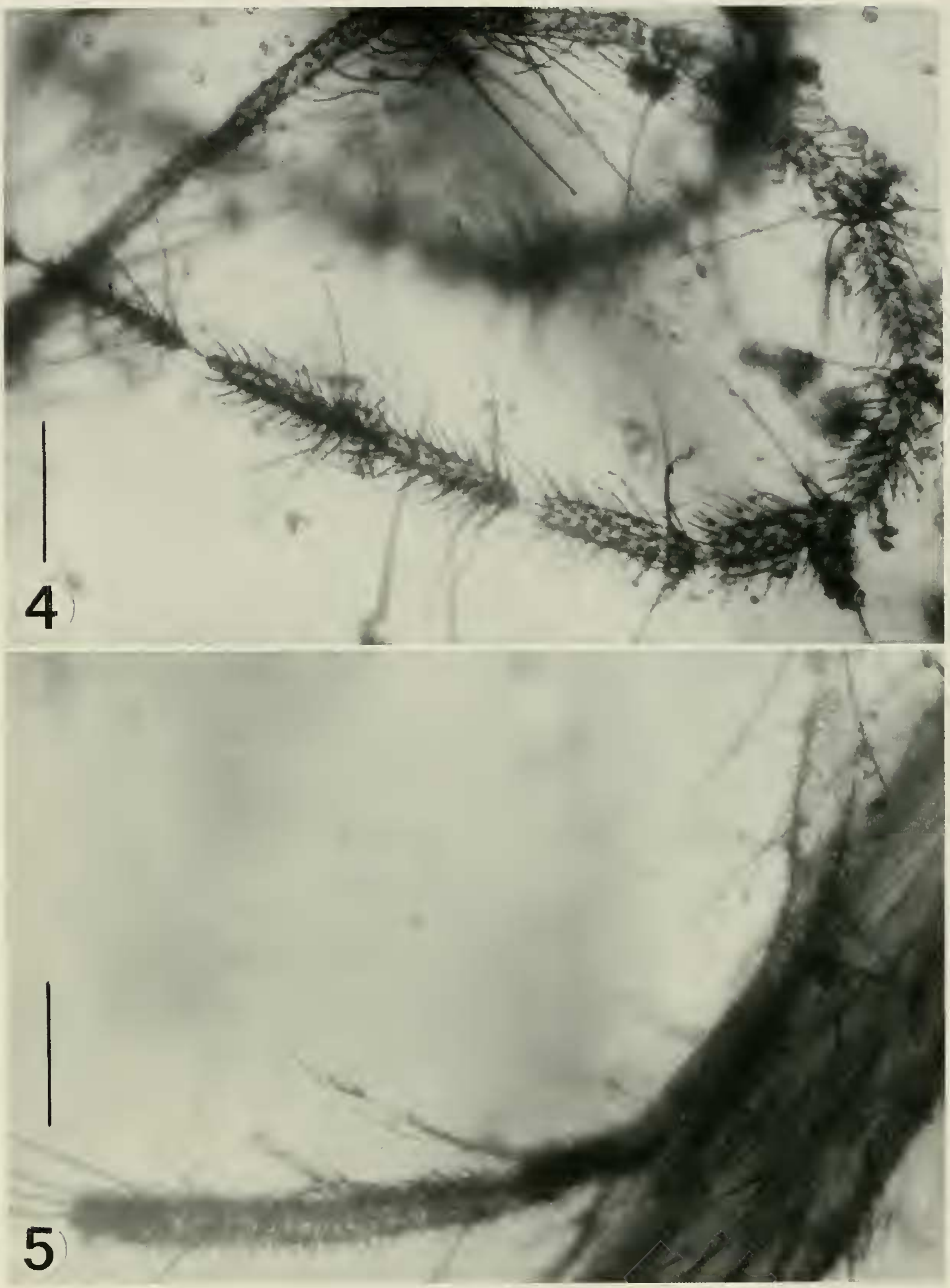
Diagnosis.—In Williams' (1933) key to the extant and fossil Tanyderidae, *D. microsoma* would align with the Baltic amber fossil *Macrochile* Loew in the couplet "wings immaculate." Whether the wings of *Macrochile* are completely hyaline is questionable since Alexander (1931) noted vague indications of dusky spots at the end of vein Sc, on r-m and at the fork of M3 and CuA1 on *M. spectrum* Loew, and Podenas (1997) noted dark areas on the wings of *M. baltica* Podenas. The two described species of *Macrochile* are large (body length from 8.2 mm to 12 mm and wing length from 4.5 mm to 8.5 mm) and have distinct anal lobes. The Rs varies from shorter to approximately the same length as R_{2+3} in *Macrochile* while it is 3 times as long as R_{2+3} in *Dacochile*. The extant and extinct Jurassic species of *Protanyderus* Handlirsch differ from *Dacochile* in having pictured wings with an anal lobe and in lacking the cu a-a_1 crossvein. The presence of a distinct cu a-a_1 crossvein, forming a cu a cell is rare in tanyderids. However, it occurs in the Patagonian species *Neoderus patagonicus* Alexander (Williams 1933).

The extinct genus *Praemacrochile* Kalugina differs from *Dacochile* in having Sc end opposite the middle of R_{4+5}, R_2 short, almost ⅓ of Sc and ⅓ of R_{2+3} and having R_{4+5} as long as or slightly longer than R_2. *Dacochile* shares some characters with *Nannotanyderus* Ansorge 1994, namely the small size and reduced anal lobe, but the latter genus is characterized by a short Rs vein, only half as long as R_{2+3}, a large cell bm and a rounded anal lobe (Ansorge 1994, Ansorge and Krzemiński 2002).

Dacochile microsoma Poinar and Brown, new species

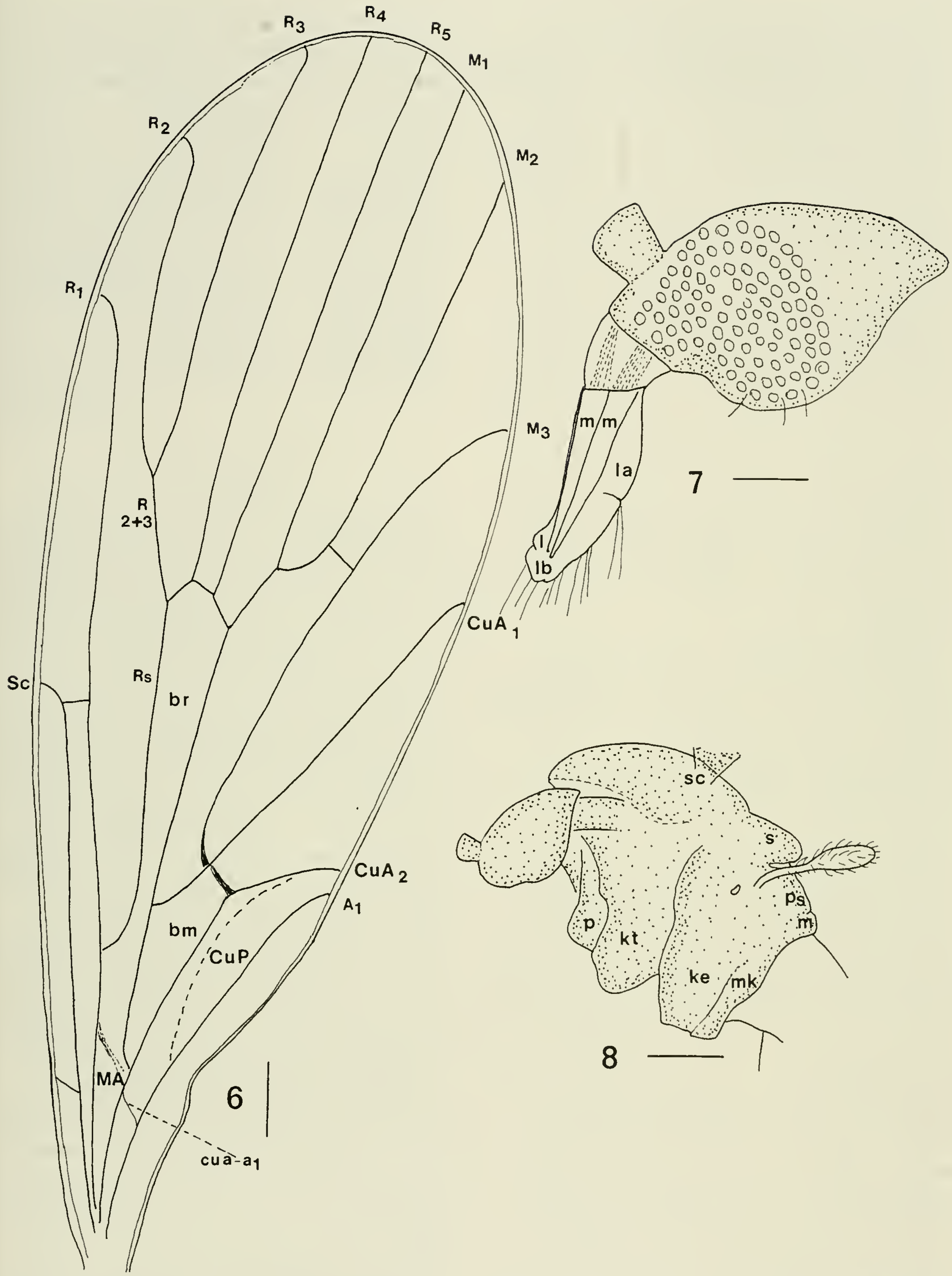
(Figs. 1–8)

Description.—Holotype female; with characters listed under the generic diagnosis. General coloration brown; body length 2.6 mm. *Head*: Length: 315 μm (not including rostrum), eyes dichoptic, with short hairs arising between facets of ommatidia; antenna 17-segmented, 2.37 mm long, segment 1: 63 μm, 2: 113 μm, 3: 63 μm, 4: 283 μm, 5: 214 μm, 6: 189 μm, 7: 189 μm, 8: 145 μm, 9: 170 μm, 10: 95 μm, 11: 107 μm, 12: 107 μm, 13: 101 μm, 14: 107 μm, 15: 107 μm, 16: 107 μm, 17: 107 μm. Antennal segments with numerous uniform setae; conspicuous verticils equal or exceed corresponding segments in length, apical segment as long as preceding segment, postpedicel short, equal in length to pedicel; maxillary palp 5-segmented, 850 μm long, with 5th segment 2.6 times as long as 4th, segment 1: 50 μm, 2: 132 μm, 3: 145 μm, 4: 145 μm, 5: 378 μm; head bearing distinct, short rostrum, 265 μm long, with strong, pointed mandibles lacking noticeable teeth on inner surface (details shown in Figs. 2, 7). *Thorax*: Brown, 790 μm long; legs yellowish brown, coxa 1: 334 μm, 2: 410 μm, 3: 422 μm, trochanter 1: 113 μm, 2: 126 μm, 3: 113 μm, femur 1: 1.28 mm, 2: 1.43 mm, 3: 1.42 mm; all tarsi and tips



Figs. 4–5. *Dacochile microsoma.* 4, Flagellomere showing verticils at the base of each segment and dense setae uniformly covering each segment. Bar = 89 μm. 5, Extremely long terminal segment of maxillary palp. Bar = 48 μm.

of tibiae missing; wing hyaline, all veins bearing setae, long setae on costa in anal area, wing membrane covered with microtrichia, Sc relatively short, less than half wing length, ending before origin of R_{2+3}; cell br over twice as long as cell bm; crossvein m-cu absent; Cu P vein faint, arising from A_1 and curving toward wing margin; base of Cu A_1 appears as crossvein; tip of veins R_1, R_2 and R_3 bent anteriorly at wing margin; anal lobe greatly reduced or possibly absent, replaced with long setae; halter brownish yellow, 258 μm long, covered with short setae; further details of venation



Figs. 6–8. *Dacochile microsoma.* 6, Wing showing veins and cells referred to in this study. Bar = 627 μm. Setae and microtrichia omitted. 7, Lateral view of head. l = labrum, la = labium, lb = labellum, m = mandible. Bar = 78 μm. 8, Lateral view of thorax. ke = katepimeron + meron, kt = katepisternum, m = metanotum, mk = metakatepisternum, p = prosternum, ps = postscutellum, s = scutellum, sc = scutum. Bar = 165 μm.

Table 1. Fossil species of Tanyderidae.

Species	Locality	Age	Reference
Dacochile microsoma, n. sp.	Burma	Cretaceous	present work
Macrochile baltica Podenas	Baltic amber	Eocene	Podenas 1997
Macrochile spectrum Loew	Baltic amber	Eocene	Loew 1850
Nannotanyderus grimmenensis A. & K.	Germany	Lower Jurassic	Ansorge & Krzemiński 2002
Nannotanyderus krzeminskii Ansorge	Germany	Lower Jurassic	Ansorge 1994
Praemacrochile chinensis K. & R.	China	Middle Jurassic	Krzemiński & Ren 2001
Praemacrochile decipiens (Bode)	Germany	Lower Jurassic	Ansorge & Krzemiński 2002
Praemacrochile dobbertinensis A. & K.	Germany	Lower Jurassic	Ansorge & Krzemiński 2002
Praemacrochile stackelbergi Kalugina	Siberia	Upper Jurassic	Kalugina & Kovalev 1985
Protanyderus mesozoicus Kalugina	Mongolia	Upper Jurassic	Kalugina 1988
Protanyderus senilis Kalugina	Mongolia	Upper Jurassic	Kalugina 1992
Protanyderus vetus Kalugina	Mongolia	Upper Jurassic	Kalugina 1992

shown in Fig. 6 and of thorax in Fig. 8. *Abdomen*: Brown, extended, 1.64 mm long, twisted unnaturally about 90° at approximately ⅔ of its length, tip of ovipositor missing.

Male.—Unknown.

Material examined.—Holotype female in Burmese amber, deposited in the Poinar amber collection (accession # B-D-12) maintained at Oregon State University.

Etymology.—Micro is from the Greek "mikros" for small and somus is from the Greek "soma" for body.

Diagnosis.—*Dacochile microsoma* is one of the smallest known members of the family. Other distinguishing characters are the short antennal postpedicel, the very short R_{2+3} and the extremely short bm cell. While members of the genus *Radinoderus* also have a relatively short R_{2+3}, they lack a cu-a cell, possess an anal lobe and have pictured wings. Most tanyderids have the terminal flagellomere shorter than the penultimate, and the terminal maxillary palp not more than twice the penultimate one (Williams 1933, Alexander 1981). However the terminal and penultimate flagellomeres are equal in *D. microsoma* and the terminal maxillary palp is 2.6 times longer than the penultimate. Unfortunately, head structures are not noted for the other Mesozoic fossil tanyderids (Table 1).

DISCUSSION

The presence of well-developed mandibles in *D. microsoma* is interesting because these structures have only been reported in the Australian genus *Radinoderus* Handlirsch and the North American *Protoplasa* Osten-Sacken (Downs and Colless 1967). In *Dacochile*, the size of the mandibles suggests that a piercing-sucking habit provided the major means of obtaining nourishment. The blood-sucking habit is well established in the Diptera, with each group evolving their own specialized type of mouthpart modification in order to obtain the food source (Downs 1970, Kalugina 1991).

It is interesting that the mouth structures closely resemble those of the Psychodidae (Quate and Vockeroth 1981). The similarity between the wing structure of Mesozoic Tanyderidae and Psychodidae has been noted, and the similarity of the mouth structure reported here supports the contention that the two families are closely related and may have originated from a common stem (Crampton 1926, Krzeminski and Evenhuis 2000).

A list of described fossil tanyderids is presented in Table 1. Twelve fossil species in 5 genera (one extant and 4 extinct) have been described, all from Old World deposits. The oldest members are from the Lower Jurassic and the youngest from the Eocene.

Only three species have been described from amber deposits. It is interesting that some of the Upper Jurassic forms have been placed in the extant genus *Protanyderus* Handlirsch. Since the Jurassic fossils were identified only on the basis of wing characters, we feel that their placement in an extant genus is premature and should be made only after an examination of body characters. If confirmed, these would represent the oldest terrestrial generic lineages, thus far limited to four insect genera found in Cretaceous Lebanese amber (Poinar and Milki 2001).

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